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SCIENCE AND MODERN CIVILIZATION[1]

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IN the human body there are many important organs each of which is controlled by nerves or internal stimuli acting in opposition to one another. The heart for example has its accelerator nerve fibers which quicken its beat and another set of inhibitor fibers which retard its activity. The balance and interaction of these controlling stimuli regulate the heart action according to the needs of the body. The same principle of control by opposed stimuli prevails in practically all activities of the body. In the arm the extensor and the flexor muscles are opposed and their interaction is necessary to properly directed movement of the arm. The same is true of the leg. The muscles that bend the body toward the right side are opposed by those which would bend it to the left. All the skeletal muscles are thus counterbalanced. In nervous control of the involuntary muscles there is a double set of nervous stimuli acting in opposition to one another. The same is true of nervous direction of secretion in glands. The internal secretions, hormones, are similarly balanced against one another. Tension, stability, accurately directed movement or chemical activity comes in physiological processes through the interaction of opposed directive stimuli. In psychic activities the same principle obtains. One finds direction secured by balancing pain against pleasure and duty against desire.

Phenomena in the inorganic realm show the same principle of control through opposed forces. The stars in their courses are thus held true to their orbits, and, at the other extreme, in the realm of the minute, molecular motion shows control through opposing forces of attraction and repulsion. The principle of direction or control of action through opposing forces or stimuli is widespread in nature.

Human society is similarly affected by opposed tendencies which like the two reins of a horse's harness guide the organism along its path. Socialism and individualism are one such pair of contrasted ideals, both sound, both esential to the guidance of society in its progress.

Our subject suggests a slightly different pair of similarly opposed ideals which may equally truly be regarded as guiding reins of society. I mean what we may call conservatism and radicalism, or traditionalism and experimentism, the binding conserving forces of society on the one hand, and the progressive ferments on the other. Perhaps as good phrases as we can find under which to summarize these two groups of influences would be traditionalism[2] and the scientific spirit.

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[1] Part of an address delivered before the Chinese Students Alliance at their conference in Oberlin, September 8, 1916.

Many men of science are accustomed to decry the spirit of conservatism but all our study of the processes of nature shows us inertia and force in opposition and the inertia is as vitally important as the force.

In human society it is well to have the conservative and the radical forces at work at the same time, but history shows us that the proper balance between them has not always been maintained. During the dark ages of the western world inertia, conservatism, traditionalism, was too dominant and stagnation was the result. During the French Revolution, on the other hand, radicalism ruled without the needed restraints and social results followed which might fairly be called explosive, so ill directed were they. It is possible for two oarsmen to propel a boat by each using his oar without reference to the other, but the progress of the boat, while real, will be very erratic in its course and the goal reached will be very uncertain. Steady progress in a desirable direction comes through properly balanced effort by the two oarsmen at the same time, each in a sense working against the other, yet the two cooperating through their opposition in the progress of the boat.

Two special features of value may be noted in the conservatism of society. To mention the lesser first, the human quality of subservience to custom makes it difficult for a new idea to make its way. It meets opposition and has to prove, often by strenuous effort, its right to prevail, and in this struggle the new conception is itself brought into truer proportions and is perfected.

But far more fundamental is the chief value of conservatism, of social custom. It is the essential foundation for stability, without which there can be no equilibrium and no equable progress. We must be able to know what to count upon in human action, otherwise we can not properly relate our own activities to those of our fellows and to that of society as a whole. If it were a matter of varying chance whether the sun should rise from day to day, if we could not tell confidently in advance whether fire would burn or not, if there were no stable predictable custom in the behavior of things animate and inanimate, chaos would result. And this is just as true of social conditions as it is of all others. Custom is the foundation of all social life and without it there could be no human society.

Custom prevails to differing degrees in the behavior of different organisms. Among the higher plants reaction is almost as predictable as in the inorganic realm. Among the lower forms of animals reaction seems to be determined by the racial or specific character of the organism rather than by its plastic response to conditions newly presented. It does what it is bred in it to do. The response, to use a common though not strictly scientific phraseology, is instinctive rather than intelligent, or we may say it is racial rather than individual. It is only among the highest animals, perhaps only in the case of man himself, that intelligent response involving judgment comes into play.

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[2] I am making no attempt in this discussion to discriminate between reasonable and unreasonable conservatism, for even unreasonable conservatism serves its useful purpose in society however much hindrance it may also cause. Of course the phrase ''scientific spirit'' should include a large measure of reasonable conservatism.

Similarly in the development of man and of society, custom was at first probably almost wholly dominant, individual independence of the group ideals being a late development. It is still true of most men that they act in accordance with social custom and not upon their own independently formed judgments. Comparatively rarely, indeed, does any person think or act in even a single instance in independence of social convention. In great preponderance, human activity is racial or communal and not individual.

But even as the presence of individuality is a sign among animals of a high place in the realm of being, so among men independence of social convention and the ability to think for one's self, the habit of self-dependent rather than socially subservient action, marks a highly developed man.

We have here a paradox. Society in its evolution comes to produce, more and more, men who are to a degree independent of society, and the percentage of such spiritually independent men in any society is perhaps a fair criterion of the degree of advancement of that society. Among the bees, the hive is everything, each individual being wholly subordinated to the group, and the presence in the hive of uncoordinated members would be disastrous. In human society, on the other hand, the presence of individuals of independent spirit is essential to the vitality of the group. Yet here, as among the bees, overemphasized individualism means the destruction of society. Two qualities, traditionalism and personal independence, two opposing ideals, socialism and individualism, working each against the other are necessary to vitality.

Some years ago, Mr. Harris, then United States commissioner of education, said (I quote from memory) that "the primary function of public education is to persuade the individual to conform to the conventions of society." Contrast this by no means false statement with another by a scholar of old, Paul of Tarsus, who said: "Test all things and hold fast that which proves to be good." The first is the word of the traditionalist and emphasizes the essential quality of social stability. The second is the utterance of the greatest heretic of Christian history and is a fair statement of the spirit of true science: prove all things and hold fast that which is good.

In China traditionalism has ruled for several centuries, and progress has been but slight. Her great need to-day is a liberal infusion of the scientific spirit, to restore the proper balance and secure progress.

But many regard the scientific spirit as dangerous. It is dangerous. It is powerful, it overthrows, it destroys, it starts things moving. But all power is a dangerous weapon, dangerous to the good when wielded by the evilly disposed or the ignorant, dangerous to intrenched evil and incompetence when wielded by the man of high ideal. Huxley was a very striking embodiment of the scientific spirit in the last generation. He was a destructive force, militant against all shams. But he was one of the greatest prophets of God in all his generation, battling manfully, inspiringly, against insincerity and dishonesty wherever found. In the Christian church he found too much respect for dogma and too little regard for truth, and he fought this evil in the church while the church fought him, but among all his Christian opponents was not one who so nobly served the church as did Huxley. The church needed castigation, needed to be held up to itself so clearly that it could see its own subservience to traditionalism, needed to recognize itself a worshiper of the "established" rather than of the true.

Huxley was a very militant example of the man of scientific spirit. One need not always be a fighter. He may be of the milder type and, while devoted to seeking and doing the truth, may let the truth do her own fighting, and she will.

In the orient conservatism has long been too dominant.[3] Society has crystallized, has lost its plasticity and is not flowing forward on its course. There are recent indications that the depths are stirring, and if an explosion is to be avoided there must be a widespread infusion of the solving influence of the scientific spirit of progress.

How can this scientific spirit be introduced? Talking about it accomplishes little. We can not merely say "go to, now, let us all be scientific." The roots of conventionalism have struck too deep into society for any easy change. The fresher spirit can come only by growth, probably at first disappointingly slow. But this growth can be helped to start and to reach a full and rich development.

It can not be helped much by precept, nor will the example of other nations be sufficient. The scientific spirit grows by exercise. The doing of the daily tasks of science brings the spirit of science. The introduction of scientific research is the means.

How can this be brought about? How may research be introduced into a nation's life and be fostered? Modern industry is increasingly dependent upon chemistry and physics and the introduction of manufacture will bring them in its train. Engineering is science of the highest order. The introduction of industrialism and its attendant engineering will make very plain the need for scientific training.

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[3] Japan should not be included in this statement.

Perhaps the most important event, the most hopeful feature in recent Chinese history is the establishment in China of institutions of modern medicine of the strongest, most scientific, type, through the great Rockefeller trust and the cooperation of missionary schools. Medicine touches human lives most intimately and brings relief to our loved ones as well as ourselves. Its appeal is peculiarly strong and vivid. The results of communal hygiene and of scientific resistance to epidemics, as well as the cure of individual maladies, make a striking appeal. Vivid realization of the contrast between modern science and tradition could perhaps nowhere else be so well presented as in medicine. It is a better introduction for the scientific spirit than is even industrialism.

But for China to gain the needed benefit from the introduction of scientific methods in medicine, industry and engineering, for her to get inspiration, to attain through them to the scientific spirit, she must engage in these activities herself. It is not enough to bring in western physicians, to import engineers and factory managers. These will be necessary, but they are not enough. Japan was very wise in one most important particular in introducing western science. She manned her universities and factories at first with western men, but she sent her sons to them to learn, and they did learn. To-day Japan is productive in all fields of scientific research, and her life is becoming as much guided by the scientific spirit as is that of the more progressive of the western nations. It is not enough that western nations should come into China, should develop her mining, her forestry, her agriculture for her, build her railroads and bridges, cure her sick, organize and direct her public health work. China must learn to do these things for herself, and through the doing, reach the real scientific spirit, the spirit of independent judgment of things upon their merits, of proving all things and holding fast that which is good. To this end industrial education, engineering colleges, schools of modern medicine, are needed. Scientific laboratories in colleges and schools and in connection with industrial establishments will teach the ways of science and develop the independent spirit of regard for truth, however contrary to tradition it may prove to be.

This may seem to some a prosaic program, but it will prove far from prosaic. The greatest adventure for a man or a nation is the search for truth and the gaining by faithful service of an unswerving loyalty to truth.

Thus far we have discussed changes that may be expected in the near future, within the next century or half century, changes that are already beginning and which are sure to gather increasing momentum.

It may not be without interest to take a look into the more distant future. What is to be China's ultimate contribution to the world? When she realizes her full development, what will be her share in the world's life?

The biologist has the principles of evolution as the background of all his thinking. He thinks of ethnic and racial problems in terms of centuries and decades of centuries whereas the sociologist thinks more in decades of years. What of the distant future as the evolutionist sees it?

True humankind came into existence apparently about half a million years ago. Of primitive man in Asia we know little, for the paleontology of Asia has been but little studied. Of man in Europe we know more. The earliest human remains in Europe are of a type of man—*Homo neanderthalensis*—now wholly extinct. He was succeeded by *Homo sapiens*, a species which in the course of many thousands of years has given rise to many offshoots which have become more or less distinctly marked subspecies or races. It seems that all races of men now existent belong to this one great species—*Homo sapiens.*

The great diversity of human races has been developed largely through isolation. Mankind spread from their center of origin out over Asia, Africa, Europe and America and the islands of the Pacific, each group coming to occupy a more or less distinct portion of the earth and each group, lacking contact with the other groups, developed independently, evolving into a race more or less divergent from the others. All of man's divergent evolution by which the several races have arisen, took place under conditions of isolation. If the ancestors of Swede and Arab, Saxon and Negro, Greek and Chinaman had all lived together and freely intermarried there would never have been any Swedes, Arabs, Saxons, Greeks or Chinamen, but instead a homogeneous race differing from them all. It is isolation which has allowed the several races of man to develop, to evolve.

But to-day isolation is rapidly being removed. Our means of transportation and of interchange of thought have been so developed, and the world's population is so increasing and spreading into all suitable quarters of the globe, that all men are rapidly becoming neighbors. We are just at the dawn of the day when all men shall live together. And this means not only interchange of cultures, but personal mingling as well. Hereafter no race can develop independently of the rest of mankind. Divergent evolution into races more and more distinct has ceased. We are entering upon a new anthropological period, a period in which divergent evolution has ended and a fusion of the races will begin. Increasing fusion will remove the present rather clearly demarcated racial diversities and the ultimate human species will be one complex race, fused from all those present races which succeed in persisting. With the intermingling of the peoples in their social life, which is increasingly coming the world over, amalgamation could not be prevented, however strongly we might desire to prevent it. The illegitimate unions that would occur, however strong might be prejudice against interracial marriage, would be enough to obliterate in time all race distinction.

In this country there has long been and there is to-day a strong prejudice against intermarriage between the negro and the white man, and those states in which the negroes chiefly live have adopted stringent laws against such intermarriage. Yet in spite of this vigorous prejudice and strict legal enactment the negro in America is rapidly becoming whitened. A few more centuries and any demarcation between negro and white man in this country can not be drawn.

The Jew has been hated in Europe for a thousand years and more. His pride has met his persecutors, and his pride and their hatred have made the strongest bar to intermarriage which one can imagine. We in America can hardly realize the bitterness of the hatred and the social ostracism of the Jew, which has obtained for centuries in Europe and western Asia. Yet in spite of this bar to racial fusion, the strongest humankind could erect, the fusion has gone steadily on. The Syrian Jew is largely a Syrian, the Spanish Jew has many Spanish characteristics. The German Jew has Teuton qualities, and the Russian Jew is largely a Slav. In each country the Jew resembles his Christian or Mohammedan neighbor as much as or more than he resembles his brother Jew in some distant country. Racial prejudice, social ostracism, legal enactment, are all powerless to stop the resistless trend toward racial fusion when diverse races are in actual contact. Amalgamation of all human races which shall survive is inevitable. Whether the thought is agreeable or disagreeable makes no difference in the result. There can be ultimately but one human race and we must fit our thinking to this fact.

From this point of view the questions of chief interest in regard to any race are, first, will it persist and form a part of the ultimate race; and, second, what will be the nature and effect of its contribution to the ultimate race?

Some races apparently will not persist but will succumb and become extinct, as a result of the closer contacts and severer rivalry of advancing civilization. The North American Indian, perhaps the noblest of all savage races, rivalled only by the Maori and the Zulu, seems destined to extinction. So also is the Pueblo Indian of the central regions of this hemisphere. Both these races are stiff and unyielding, too lacking in plasticity to make the necessary readjustments in their character to allow them to fit with their new neighbors into the complex life of the mixed race which is to people America. Indeed both of these highly developed American native peoples are already approaching extinction.

The aborigines of Australia are going the same road to destruction and the Tasmanians are already extinct. Without ill treatment, but merely through their own lack of adaptability, it seems that some, perhaps many, of the less numerous races must succumb under the new conditions so rapidly approaching. But not all the more primitive races are headed toward extinction. The negro has shown himself very adaptable. He fits into such place as is given him and readily learns the ways of complex society, showing a remarkably high capacity for social education.

It is no easy thing to say which races will persist and which will drop out. We can not safely say the races at present well advanced will continue and that the backward are doomed. The problem is one that has received very little study and it will long form a most enticing puzzle.

If there is any race that seems sure to persist and form a great part of the ultimate race, it is the Chinese. Their great numbers, their remarkable ability to live upon a low economic plane and to thrive, their love of peace, their great stability of personal character, their fine intellectual abilities and their capacity for response to the highest moral conceptions all indicate that the race will persist and will form numerically at least a most important element in the ultimate race.

But what of their influence in guiding and determining the type of civilization under which this ultimate race shall live? Will the Chinese contribute as much intellectually and morally as they will in numbers? This probably depends largely upon their success in wisely guiding their own growth under the new conditions that are approaching.

China has already made a major contribution to human progress. The ancient civilization of China spread to Korea and then to Japan and has profoundly influenced a great portion of mankind. Can she "come back," as the athletes say, and make another great contribution to the social development of the world? No nation has ever yet succeeded in making a second major contribution to the world's progress. Egypt, Assyria, Phoenicia, Greece, Rome, Arabia, Persia have each reached a high degree of culture and have then gone down. The Italian Renaissance, the only apparent exception, was not a revival of old Rome. Much foreign blood had been infused into the old Italian stock till they were an essentially new people.

Thirty years ago Edward Carpenter in a keenly interesting essay—"Civilization, its Cause and Cure"—showed the course of what he called the disease of civilization among those peoples which had reached a high degree of social development and had become dominant each in its turn. This disease has had much the same prodromal stages in all cases, has culminated in a feverish development and has left the race permanently weakened. No people thus far in the world's history has ever made a good recovery or grown again into world power.

Will China prove an exception? She has once profoundly influenced the world's progress and at that time she reached a degree of culture which in art at least and possibly in some other features is still unsurpassed. Since this, her perihelion, China has gone down, and in later centuries the world has moved on scarcely conscious of China's existence. She has been a fallow field, lying quiet and producing little if any growth. Will she prove like the farmer's fallow field? Has her potential fertility been increasing during these centuries of inactivity? Is she now ready to receive new seed and produce again rich fruit? Who can say? It really seems as if she might be the first of all peoples to show this miracle of regeneration.

Is the disease civilization necessarily and inevitably so disastrous as it has thus far proved for all peoples? May it be that there is an untried cure, an antitoxin that will neutralize its poison? I believe there is such an antidote if we prove able to apply it.

Our knowledge of the principles of breeding, of genetics, is becoming such that we could, if we would, breed a progressively perfecting race. But you know the reply of the small boy who was asked if he couldn't behave for just an hour. He said: "Oh, I could if I would. But I couldn't would." We can breed a stronger and stronger human race if we will, but can we will?

Let us look a moment at this science of genetics and see a little of its phenomena and methods. It is only within the last half generation that we have come to know what it is that is inherited. A man does not inherit a general resemblance to either of his parents or a general blend of the two. He inherits, rather, definite particular qualities and his character is a complex mosaic made up of these many units. Or to be more accurate we should say he receives from his parents, many minute particles of protoplasm each of which is a determiner for a particular unit quality. In general there are two determiners, for each unit quality, one from one parent and the other from the second parent, and the nature of any particular unit quality in the offspring depends upon the interaction of its two determiners, the one received from the male parent, the other from the female parent.

This is not an appropriate occasion for discussing in any detail the phenomena of inheritance. For our present purpose it is sufficient to say that we have learned how so to manipulate organisms in breeding that we can select and combine their unit qualities in almost any manner we choose, thus controlling, predetermining, the nature of the organisms. For example, some years ago there were known two esteemed varieties of the tobacco plant, one with very large leaves and the other with very numerous leaves. It was determined to combine these two and thus get a variety with both very numerous and very large leaves, and this was easily done. We can control and predetermine the character of animals in the same way. This would be as true of man as of any other animal, if we were free to control human marriage as readily as we determine matings in animal breeding. But, of course, this is not possible, and without such definite and exact control over marriage the process of eugenic improvement in humankind must be very slow.

The subject is one requiring extended and very careful treatment and can not really be included in our thought this morning, though it is the most important thing of all in considering the outlook for the ultimate human race. Let me leave with you just this one suggestion. We can so educate ourselves to higher and higher ideals that not physical beauty nor prowess alone, not intellectual ability nor moral power alone shall seem sufficient, but our standards of manhood and womanhood may be brought to include thorough wholesomeness physically, intellectually and morally, until one deficient in any of these respects shall be recognized as undesirable in marriage. When that time comes the steady pressure of this high ideal of what constitutes attractiveness in marriage will secure eugenic progress. I commend to you for study and careful thought this most keenly interesting subject of eugenics, far too great for any discussion in the few minutes still at our disposal. But in eugenics, I am convinced, lies the future of mankind, and the hope of his escape from the menace of degeneration through the luxury of wealth and ease. This, the newest of the sciences—the science of genetics—will yet show us how to control intelligently the development of mankind in order to reach the fullest realization of their possibilities. This is the science which will be dominant in the ultimate human society.

But this is a long look ahead. Thousands of years will be needed for the perfecting of mankind, even with the powerful aid of eugenic science. The present problem is to set all the nations of the earth upon the road of progress. The vision of the distant heights to be ultimately attained must not make us impatient of the plodding toil along the way. Let the vision rather inspire us to take intelligently the first steps and to continue steadfastly in the path.

The first thing is to introduce and then to cultivate the scientific spirit of search for truth, and to this end let us encourage all the arts and industries that bring us into daily contact with experimental science. Thus by doing the homely tasks of science we shall find the spirit of science entering our souls, this spirit which is the spirit of progress. Let us thus learn fearlessly to test all things, however sacred they may have become through long established custom, and let us with high resolve, hold fast to that which proves itself to be good.